Technique for Enhancement of Bandwidth for Microstrip Patch Antenna for Applications like WLAN

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Abstract—*This communication presents a method to enhance the bandwidth of microstrip antenna by cutting a slot in the patch. Firstly, an antenna using inset microstrip line feed is designed for 5.2 GHz WLAN application. The bandwidth of antenna is found to be 170 MHz; which increases to 236 MHz when a rectangular slot is cut from the patch. The directivity of both the antennas resonating at 5.2 GHz is found to be 5.89 dB. CST studio is used as the software tool. Duroid substrate having a dimension of 28 mm ×36 mm×1.604 mm is used as the base of the antenna, giving the volume of the antenna to be 1.616cm3. Thus, this volume makes the antenna suitable for WLAN application.*

Keywords—Duroid, Microstrip, WLAN, Microstrip, Directivity

I. INTRODUCTION

The simplest patch antenna uses a patch which is one-half wavelength long, mounted a precise distance above a larger ground plane, sometimes using a spacer made of a dielectric between them. The current flow is along the direction of the feed wire. A simple patch antenna of this type radiates a linearly polarized wave. The radiation can be regarded as being produced by the ''radiating slots'' at top and bottom, or equivalently as a result of the current flowing on the patch and the ground plane.

Microstrip is probably the most successful and revolutionary antenna technology. Its success stems from very-well-known advantageous and distinctive properties, such as a low profile, light weight, planar structure (but also conformal to non-planar configurations), mechanical robustness, easy (simple and low-cost) fabrication, easy integration of passive and active components, easy incorporation in arrays, and notable versatility in terms of electromagnetic characteristics (resonant frequency, input impedance, radiation pattern, gain, polarization).

The bandwidth of the microstrip antenna usually ranges from less than 1% to several percent [1]. This paper experimentally investigates an alternative approach in enhancing the bandwidth of microstrip antenna for the Wireless Local Area Network (WLAN) application operating at a frequency of 5.2 GHz. The result of this paper shows that enhancement of the original bandwidth can be achieved by using slot with proper position selection. This paper presents the use of transmission line method to analysis the rectangular microstrip antenna. Using CST Studio Suite(2011)software proposed antenna is designed/simulated and optimized. The bandwidth, gain, radiation pattern are evaluated with the help of this software.

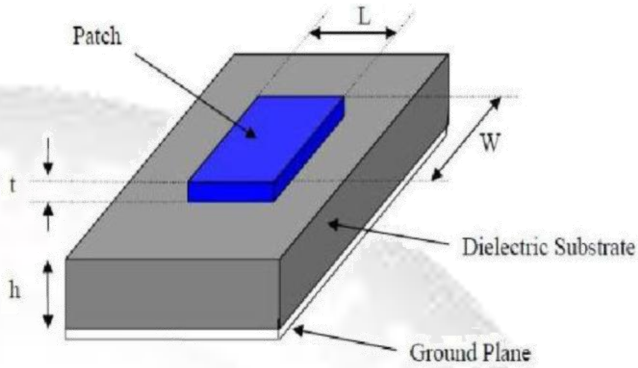

Fig. 1: Patch Antenna Structure

II. ANTENNA GEOMETRY

A. *Without Slot*

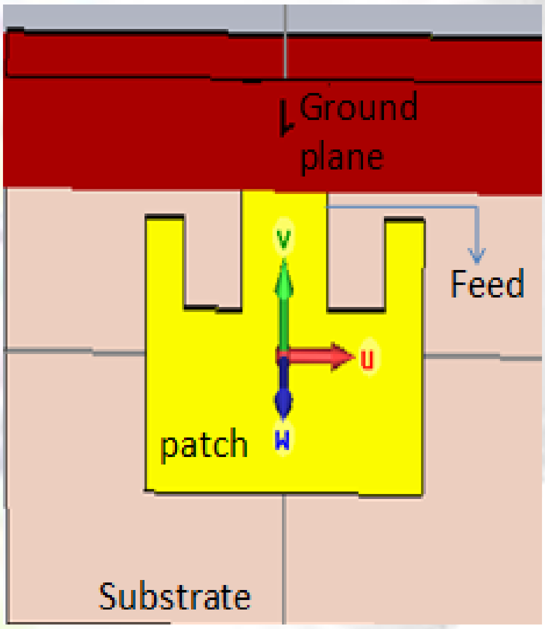

Fig. 2: Components of Antenna Geometery(No Slot)

Name	Value
Fi	4.5
Gpf (Gap between patch and feed)	1.49
L(Length of patch)	11.96
Lf (Length of feed)	11
Mt (Thickness of copper layer on FR4 substrate)	0.1
W(Width of patch)	18.1
Wf(Width of feed)	3
H (Thickness of substrate)	1.6

Table. 1 : Various Parameter Values

B. With Slot

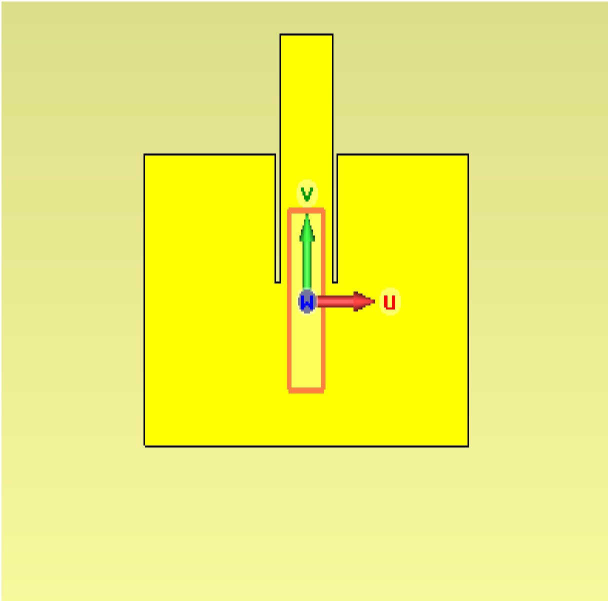

Fig. 3: Components of Antenna Geometry (With Slot)

U_{min} = -1
U_{max} = +1
V_{min} =-4
V_{max} =+4

III. Result and Discussion

A. Return Loss

The bandwidth difference increases from d= 0.1684 to d=0.2303 on introducing the slots in microstrip patch antenna. [4]

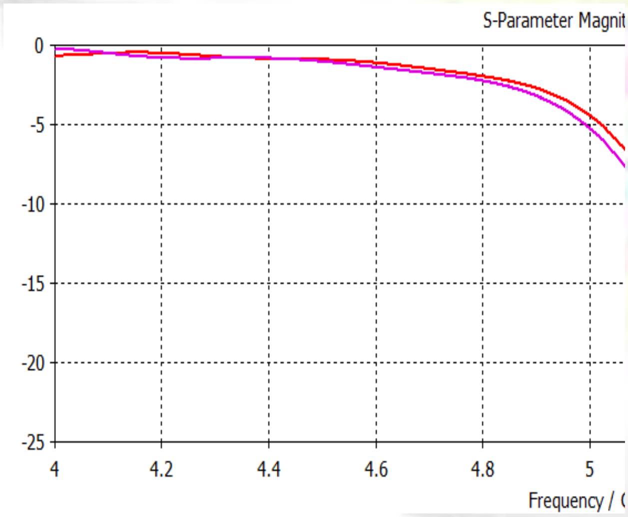

Fig. 4: Return Loss Curve

B. Directivity

It may be defined as the ratio of maximum radiation intensity of the test antenna to its average radiation intensity.

Alternatively, Directivity is the ratio of maximum radiation intensity of the subject antenna to the radiation intensity of an isotropic antenna radiating the same total power.[7].

1) Antenna without slots

At frequency 5.2 GHz, Main lobe magnitude comes out to be 6.9dBi. Main lobe direction and angular width are 1.0 deg and 97.4 deg respectively. And the side lobe level is found to be -13.4dB.[8]

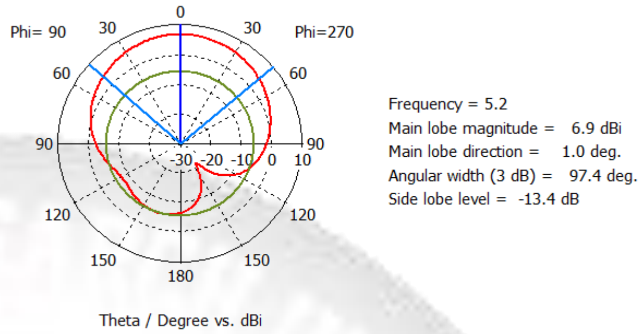

Fig. 5: FarField Directivity (Without Slots)

2) Antenna with slots

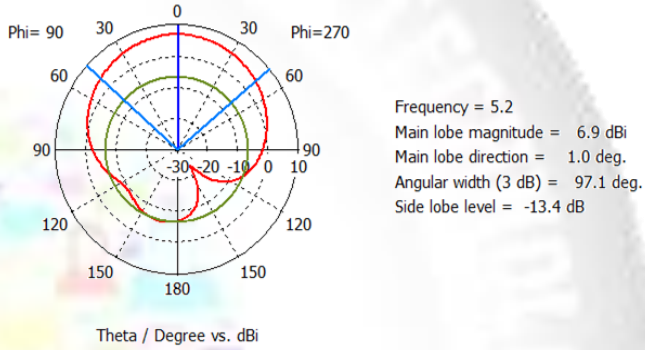

Fig. 6: Far field Directivity-With Slots(Phi=90)

Now, on introduction of slots, at the same frequency, that is, 5.2 GHz [3], main lobe magnitude becomes 6.9dBi, main lobe direction 1.0 deg, angular width 97.1 deg and side lobe level 13.4dB

IV. Conclusion

The technique for enhancing bandwidth of the microstrip antenna has been shown and it can be used for WLAN applications. As mentioned, this technique has its advantages such as it does not increase the lateral size of the microstrip antenna and disadvantages such as it increases the height of the microstrip antenna. Thus microstrip patch antenna has been designed. As it had a restricted and a narrow bandwidth we applied techniques to enhance its bandwidth,i.e, by cutting slots and introducing parasitic patch.

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